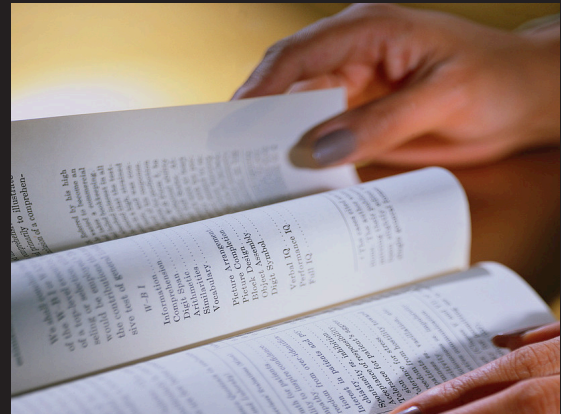
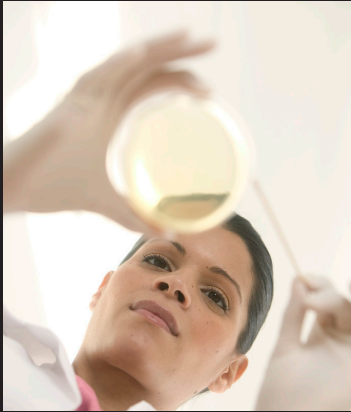


KENTUCKY COUNCIL ON
POSTSECONDARY EDUCATION



KNOWLEDGE-BASED ECONOMY 2007 ANNUAL REPORT



Kentucky Council on Postsecondary Education
1024 Capital Center Dr., Suite 320
Frankfort, Ky 40601
Phone: (502) 573-1555
Fax: (502) 573-1535
Web site: <http://cpe.ky.gov>

The Kentucky Council on Postsecondary Education is Kentucky's statewide postsecondary and adult education coordinating agency charged with leading the reform efforts envisioned by state policy leaders in the Kentucky Postsecondary Education Improvement Act of 1997. The Council does not discriminate on the basis of race, color, national origin, sex, religion, age, or disability in employment or the provision of services, and provides, upon request, reasonable accommodation, including auxiliary aids and services necessary to afford individuals with disabilities an equal opportunity to participate in all programs and activities.

Printed with state funds
February 2008

Table of Contents

	Page
Introduction	1
Intellectual Capital and Wealth Management	2
Kentucky Science and Technology Corporation	2
Program Descriptions	5
Priority Focus Areas	6
Statewide Impact	7
Endowment Match Program – “Bucks for Brains”	8
Science, Technology, Engineering, and Mathematics (STEM)	
Initiative	9
Translational Research	12
Regional Stewardship Program	12
Kentucky’s Technology Infrastructure	14
The Kentucky Education Network	14
Internet2	15
KyRON	17
Kentucky Virtual Campus and Virtual Library	17
Educational Pipelines to Knowledge-Based Economies	18
Statewide Joint Engineering Program	18
Teacher Quality Initiatives	19
2007 Teacher Quality Summit	19
Educational Leadership Redesign	19
Other Pipeline Initiatives	20
Kentucky Satellite Project	20
National Math and Science Initiative	20
College Transfer	20
GEAR UP	22
Adult Education	23
Kentucky Adult Learner Initiative	23
Knowledge-Based Economy: Summary and Next Steps	25
References	27

Council on Postsecondary Education

2007 Annual Report

House Bill 572 Knowledge-Based Economy Programs

Introduction

The Kentucky Innovation Act, HB 572, 2000 Regular Session, created knowledge-based economy (KBE) programs housed at the Council on Postsecondary Education (Council) and the Cabinet for Economic Development. The legislation supported research and development programs and provided funding necessary to create, attract, incubate, and grow high-tech and biotech firms, and to modernize existing manufacturing services. The Council is responsible for submitting an annual report of these programs to the Kentucky Innovation Commission, the Governor, and the General Assembly. This report includes progress made in achieving each program's purposes, qualitative and quantitative information concerning the applications received, projects approved and undertaken, companies served, funding amounts invested in each project or program, and findings and recommendations to increase each program's effectiveness.

The report begins with programs designed to increase the intellectual capital that creates wealth. The Kentucky Science and Technology Corporation is contracted through a competitive proposal response to manage and administer a variety of KBE activities with investments in rural innovation, research and development, commercialization, and science and engineering contracts, funded federally through a network of federal-state partnerships. Detailed reporting of these various "funds" and their differentiation are found in the full report www.cpe.ky.gov/policies/economic/KnowledgeEc.htm.¹ The table on page 4 provides a summary of the activities of the KSTC-managed KBE funds for the last six years.

Kentucky's postsecondary institutions are engaged in a number of other KBE activities, individually and collaboratively. These efforts are funded through a variety of sources including the Innovation Act Investment Funds and Science and Technology Trust Funds. This report is a summary *only* of the various activities administered and conducted directly by the Council. It is organized into three categories, **Intellectual Capital and Wealth Management** programs, **Educational Pipelines to Knowledge-Based Economy** programs designed to support ventures of a KBE in Kentucky, and **Knowledge-Based Economy: Summary and Next Steps** tied to the Council's *Double the Numbers* goals for 2020².

Intellectual Capital and Wealth Management

Kentucky Science and Technology Corporation

The Kentucky Science and Technology Corporation (KSTC) is an independent nonprofit enterprise incorporated in 1987. Its longstanding mission is “to enhance the capacity of people companies and organizations to develop and apply science and technology and compete responsibly in the global marketplace.” The board of directors is self-appointing with representatives from the private sector, education including the public and private universities, and other organizations relevant to the KSTC mission.

Kentucky’s Science and Technology Strategy (1999) was produced by KSTC in coordination with public and private sector partners and remains a testament to its commitment to advancing innovation in general and the resultant Kentucky Innovation Act specifically. KSTC cumulative performance highlights are provided on the following page.

Investment Goals

During this reporting period, KSTC’s implementation of KBE programs has continued to focus on building the capacity for these KBE investments to:

- Attract highly competitive follow-on venture funding for companies and federal funding for researchers.
- Generate a direct return on investment (ROI) back to the KBE efforts through private placements.
- Create new companies and new knowledge-driven jobs.
- Be supported by world-class peer review and due diligence infrastructures.
- Generate new intellectual property.

Program Performance

Since inception of the KBE programs, KSTC has made strong progress on a number of fronts:

- Overall growth of the KBE portfolio has grown from \$2.3 million in 2001 to \$43 million invested in a total of 939 awards.
- 45 private placements in this KBE portfolio producing 14 exits valued at just over \$1.8 million in ROI.
- Growth in follow-on funding generated by awardees to \$468 million from venture, federal, and other private sources.
- In conjunction with the Kentucky Enterprise Fund (KEF) and Innovation and Commercialization Center (ICC) Network, 328 new companies and 2,996 new jobs have been created among Kentucky Enterprise Fund (KEF), Kentucky Science and Engineering Foundation (KSEF), and Experimental Program to Stimulate Competitive Research (EPSCoR).
- Ongoing refinements of due diligence protocols have strengthened critical processes.

- Significant growth in high quality proposals, having strong potential for economic development through patents and commercialization, has been recommended for funding that exceed available funds resulting in the Council's request for program expansion in the 2008-10 budget. KSTC analysts estimate that over \$100 million has been in lost ROI from lack of available funding.

**Cumulative Performance Highlights: FY02-FY07
July 2, 2001 – June 30, 2007**

939 Investments*

(254 companies, 14 postsecondary institutions, 58 Kentucky counties)

\$43 Million State CPE/KBE Funds Invested*

\$468 Million Follow-On Investments**

45 currently active contracts with negotiated payback

\$1.8 Million value of ROI from Exits by 14 companies

(with \$7.7 million current total value of KBE private placements)

2996 Jobs Created**

328 Companies Formed**

493 Intellectual Property Actions:

223 patents, 18 provisional patents, 74 invention disclosures,
94 patent applications, 1 utility patent,
10 trade secrets, 29 copyrights, and 45 trademarks

* These investments were made under nationally competitive due diligence and professional expert reviews of 1,684 applications which requested over \$100.5 million.

** Because of the close interrelationships between the Kentucky Enterprise Fund and the Innovation and Commercialization Centers, these numbers include unduplicated numbers from both programs, as well as KSEF and EPSCoR.

Program Operations

- The model for assessing the "potential for exponential growth" (PEG Factor) has been implemented for appropriate projects under consideration for funding. The purpose of the "tool," a direct outgrowth of the per capita income analysis (PCI), is to help determine which projects, companies, etc., possess a high potential for fast "breakout" growth and wealth creation.

- The new position of investment analyst was created and filled to assist the active management of KEF investments.
- Functional operation of the Kentucky Commercialization Fund (KCF) has been transferred to the staff of the Kentucky Science and Engineering Foundation (KSEF), previously approved by CPE.
- As the complexity of the KBE/CPE programs continues to evolve, KSTC has initiated a review of the KBE program protocols to help ensure ongoing compliance of processes and practices with KBE directives.

Capacity Building

Investments under the *Kentucky Enterprise Fund* (KEF) have:

- Leveraged \$100 million follow-on investments in 239 KBE companies.
- Produced 70 contracts with negotiated payback by KBE companies (private placements); 42 remain in portfolio as of this report, which includes 13 exits generating actual ROI.
- Formed 190 new companies.
- Created 1,933 new jobs.
- Resulted in 316 patent and related IP activities.
- Generated 489 customized financial plans, valuations, and go-to-market plans and 349 active ICC clients.
- Increased the K-Net (network of investors) to 143 angel/VC investors.
- Helped create five new venture clubs.

Investments under the *Kentucky Science & Engineering Foundation* (KSEF) have:

- Resulted in eight of the 12 recipients of the prestigious NSF CAREER Award being KSEF RDE awardees/principal investigators (PIs).
- Leveraged \$94 million from 234 federal grants, industrial, and private sources.
- Produced private placements with three small companies, with one exit valued at \$67,900.
- Produced 14 patents, 51 invention disclosures, 36 patent applications, and nine provisional patent applications, as well as three patents, five patent applications, one provisional patent, and four invention disclosures from KCF investments.
- Generated 70 SBIR/STTR early-phase proposals resulting in the development and submission of Phase I-II applications to seven federal agencies.
- Generated a growing database of 8,944 international expert peer reviewers for external due diligence process.
- Resulted in 976 manuscripts published from 1,264 publication submissions.
- Produced 1,665 conference presentations on sponsored research.
- Involved 548 faculty and students in KSEF research grants.
- Established Kentucky Satellite Enterprise (KySAT), a collaborative university and public/private investment in teaching and learning of space design, resulting in Kentucky's first satellite launch in November 2007, with investors' interest for future research payloads, among them NearSpace technology via satellite for agricultural monitoring. (See www.KySAT.com)

Investments under the *Kentucky EPSCoR Program* have:

- Leveraged \$273 million from 609 federal grants in follow-on funding.
- Produced seven patents, 29 patent applications, and 18 invention disclosures.
- Resulted in 1,256 manuscripts published to date.
- Produced 2,000 conference presentations on sponsored research.
- Generated 515 new full-time and part-time research positions among faculty, university staff, and students.

Investment Approach

The implementation of these KBE programs represents a new approach to investing Kentucky funds in Kentucky's future. The newest KBE programs, The Fund and KSEF, have been designed by KSTC as investments with contractual expectations for ROIs upon financial triggers when a new technology begins to generate substantial revenues. The ROI payback arrangements, primarily for KEF investments, are the first of their kind in Kentucky, whereby any negotiated financial returns are to be reinvested in KBE programs. In 2005 and 2006, KSTC received the first payments and stock conversions under these contracts. Chapter II of the KSTC annual report¹ on the Kentucky Enterprise Fund offers a report on the status of the KEF private placements. As a result of this strategy investment in CPE/KSTC, programs have and will continue to generate increased revenues for Kentucky's KBE efforts.

Program Descriptions*

KSTC has entered into annual contracts since 2001 with the Commonwealth of Kentucky through the Council on Postsecondary Education (CPE) to create, manage and develop various KBE programs. These include the following programs:

Rural Innovation Fund – This program, designed to meet the unique needs of rural science and technology entrepreneurial companies (which are distinguished from small businesses by several characteristics including knowledge-driven profile and growth potential), provides seed and early-stage funding to emerging enterprises.

R&D Voucher Fund – This fund provides early-stage funding to science and technology-driven companies growing out of or working in collaboration with a Kentucky college or university. A determination of science and technology merit is an essential element of this program. This initiative operates closely with colleges and universities in large part to assist them in expanding their technological and entrepreneurial capabilities. The ICC Concept Pool is an important carve-out of the R&D Voucher allocation to further meet the evolving capital needs of companies. These one-time investments which strategically fulfill a particular funding niche must be made in enterprises already known through prior due diligence and investments largely through the R&D Voucher Fund and ICC network.

The Gap Fund (including the Executive-in-Residence program) is the new carve-out of the portfolio of "investment" tools that provides critical Round 2 funding to exceptionally promising companies to support essential business development functions. The program targets companies that have already established themselves formally with the KSTC staff and KBE portfolio.

Executive-in-Residence (EIR) – Recruits and deploys experienced business talent to start-up and growing portfolio companies.

Private Placements – KSTC has designed and executed an infrastructure and process for the “payback” or cash return-on-investment (ROI) for appropriate projects. This system developed by KSTC enables Kentucky (for the first time in projects of this nature) to actively participate as a “shareholder” in companies and thus also a player in entrepreneurial investment markets. This allows the state and CPE to be in a position to generate cash returns in addition to the primary economic development outcomes of these investments.

Innovation and Commercialization Centers (ICCs) – KSTC, through a partnership with the Department for Commercialization and Innovation (DCI), manages a network of business accelerators that provide direct assistance to new and emerging companies in an effort to help them start, grow, and ultimately achieve “investment grade” status. The ICCs are a fully integrated part of the overall KBE initiative and help provide deal flow, company building services, and marketing, especially for the Kentucky Enterprise Fund.

Kentucky Commercialization Fund – This fund supports technology commercialization projects within universities prior to the formation of a company. These are projects that are beyond the fundamental R&D stage and are moving downstream on the entrepreneurial food chain. A high-level evaluation of science and technology merit is a major aspect of this fund.

Kentucky Science and Engineering Foundation – KSEF has been created as a means to increase Kentucky’s capacity to become a leader state in competitive research by making its own investments in peer-reviewed science and engineering research and by attracting more research funding from all sources to the Commonwealth. KSEF conducts “peer-reviewed science and engineering research, working to increase federal and private-sector funding for research and development in Kentucky”.

Kentucky EPSCoR Program – Since 1985 this program has served to enhance the research and intellectual capacity of colleges and universities in Kentucky. KSTC has managed the Kentucky EPSCoR program since 1993. This Kentucky program works with and has received funding from a range of federal science and technology agencies including NSF, NASA, DOD, NIH, DOE, and EPA.

* Full descriptions of each of these funds may be found at www.kstc.com.

Priority Focus Areas

Consistent with the priority focus areas established by the state, KSTC has invested funds under the Kentucky Enterprise Fund (KEF) and the Kentucky Science and Engineering Foundation (KSEF) exclusively in the areas of biosciences, environmental and energy technologies, human health and development, information technologies and communications, and materials science and advanced manufacturing. The Kentucky Experimental Program to Stimulate Competitive Research (EPSCoR) has made these a priority where feasible in complying with guidelines with

the federal agencies that sponsor EPSCoR funding and with other priorities set by the Statewide EPSCoR Committee. A searchable database of all awards is available online at www.kstc.com for viewing activity in each of these focus areas, by university, by region, and by KBE funding program.

Statewide Impact

Geographic Distribution of KBE Investments – The map below displays the location of KSTC’s KBE investments to date (FY02-FY07) in named counties shown in the darker tan. Also noted above are the location of the six Innovation and Commercialization Centers (ICCs) and six Rural Innovation Centers, along with the Statewide ICC Network Headquarters located at KSTC.



Endowment Match Program – “Bucks for Brains”

In addition to the many investments of KSTC with the KBE funds that support the Innovation Act, the Council also is host to the Bucks for Brains Program.

In October 2007, CPE issued a report entitled *Ten Year Anniversary Assessment of Kentucky’s Bucks for Brains Initiative*. A commemorative brochure was also created entitled *Kentucky’s Bucks for Brains Initiative: The Vision, the Investment, the Future 1997-2007*.³

Documents from the June 30, 2006, report list private gifts that have been leveraged through matching state funds provided by the Bucks for Brains initiative.

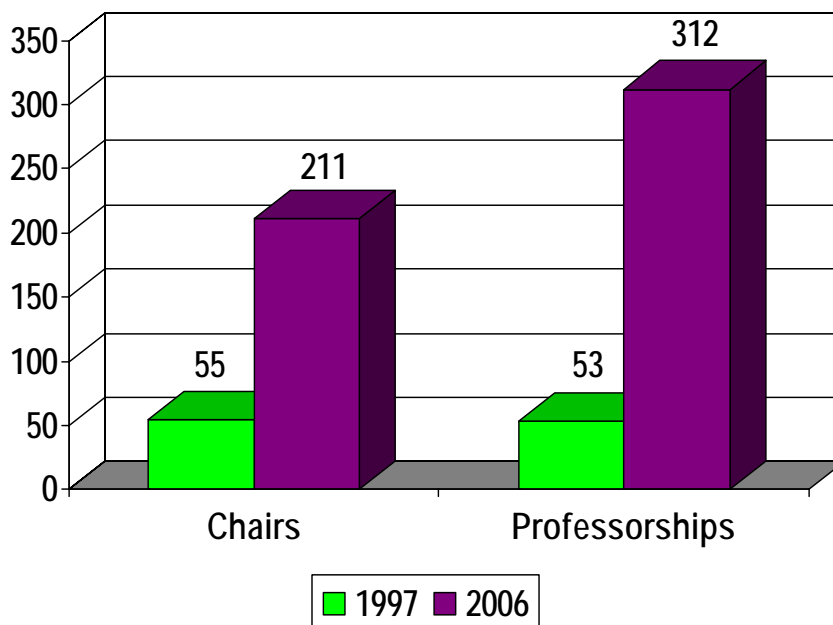
University of Kentucky	\$153,722,882
University of Louisville	82,731,805
Eastern Kentucky University.....	10,213,837
Kentucky State University	1,745,683
Morehead State University	6,645,655
Murray State University.....	8,380,683
Northern Kentucky University	8,033,753
Western Kentucky University.....	10,746,183
Total	\$282,220,481

As of 2006, additional returns on Kentucky’s Bucks for Brains investment include the following:

- 47 percent increase in annual giving at UK and UofL.
- \$1 billion increase in the market value of endowment assets at UK and UofL.
- 159 B4B endowed chairs and 227 endowed professorships appointed at universities.
- 17 percent of all federal R&D expenditures generated by B4B faculty.
- 14 percent of all extramural R&D expenditures generated by B4B faculty.
- 30 percent of Kentucky’s new U.S. patent applications generated by B4B faculty.
- 36 percent of Kentucky start-up companies dependent on university-generated technology created by B4B faculty.

The number of endowed chairs and professorships at Kentucky public universities increased markedly in the decade following implementation of the Bucks for Brains initiative. Between 1997 and 2006, the number of endowed chairs at all universities increased from 55 to 211, or by 284 percent, and the number of endowed professorships increased from 53 to 312, or by 489 percent. These data are graphed below. This level of growth in intellectual talent would not have been possible without the Bucks for Brains initiative.

Endowed Chairs and Professorships Created at All Universities



Science, Technology, Engineering, and Mathematics (STEM) Initiative

Much of the work of the Bucks for Brains scholars' work has been directed toward STEM research. Numerous national studies have indicated that growth in the STEM workforce and research is hampered due to the lack of prepared students to enter such disciplines. To address this shortage, the Council established the STEM Task Force in 2007.

The CPE Stem Task Force is comprised of 110 leaders from the executive and legislative branches of state government, P-12 and higher education, and the business, nonprofit, professional, and organizational sectors of the Commonwealth of Kentucky. The following timeline guided the ongoing work of the STEM Task Force:

- August – October 2006 – John Hall, Chair of the Research, Economic Development, and Commercialization Policy Group recommends formation of the CPE STEM Task Force.
- November 2006 – Council approves creation of the STEM Task Force; Lee Todd appointed as chair.
- December 2006 – First meeting of the CPE STEM Task Force.
- January 2007 – Second meeting of the CPE STEM Task Force.

- February 2007 – Third meeting of the CPE STEM Task Force.
- March 2007 – Release of the CPE STEM Task Force report and recommendations
- April–August 2007 – STEM Task Force study groups meet to develop implementation action plans for the STEM Task Force recommendations.
- September–December 2007 – Budget planning processes incorporate STEM Task Force recommendations. CPE requests \$5 million to implement the preliminary recommendations of the STEM Task Force.
- December 2007 – Implementation action plans released.
- January 2008 – Designated study groups report strategic actions for each recommendation.

STEM Task Force Recommendations

1. Create incentives and a supportive environment for students, teachers, and institutions that pursue and succeed in STEM disciplines throughout the P-20 pipeline.
2. Implement international benchmarks and best practices in professional development programs for P-16 STEM teachers to increase the intensity, duration, and rigor of professional development.
3. Improve teacher preparation programs and encourage people with graduate STEM degrees to enter the teaching profession.
4. Revolutionize how STEM subjects are learned, taught, and assessed and implement a statewide research-based STEM curriculum that is aligned with global workforce and academic standards.
5. Engage business, industry, and civic leaders to improve STEM education and skills in the Commonwealth and to create incentives for Kentucky businesses that employ and invest in STEM-educated students.
6. Fund a statewide public awareness campaign to help Kentuckians understand the critical importance of STEM to their own economic competitiveness and to that of the Commonwealth.
7. Develop an ongoing, coordinated statewide STEM initiative that maximizes the impact of resources among state agencies, schools, universities, and businesses and is focused on developing and attracting STEM-related jobs to Kentucky.
8. Target energy sustainability problems and opportunities in Kentucky and the nation as a primary objective of statewide STEM enhancements.

Active participation by members of the task force continues with additional P-16 educators and public/private stakeholders asked to join efforts developing specific plans of action to implement each task force recommendation. The Council's 2008-10 budget request includes funding to advance the STEM initiative.

Translational Research

Translational research is a powerful process that drives the state's economy. Research in STEM-related fields must be translated into practical applications to drive economic development and wealth creation. In the medical arena, scientists are increasingly aware of the bench-to-bedside approach to translational research. Basic scientists in all fields of discovery wish to *translate* their research findings into improved human health or commercialize their ideas into economic gain.

To recognize the importance of translational research, stimulate new research, and to introduce the scholars' translational research work to their colleagues and interested students, an inaugural Translational Research Forum was held in the fall of 2007. Sponsored by the University of Louisville in partnership with the University of Kentucky and the Council on Postsecondary Education and partially sponsored by the Jewish Hospital Cardiovascular Innovation Institute, the forum showcased current research and commercialization enterprises at UK and UofL.

Vicki Loise, executive director of the Association for University Technology Managers, delivered the keynote luncheon speech which focused on the international impact of university-based research.

Question 5 of the CPE Public Agenda for Adult and Postsecondary Education asks "Are Kentucky's people, communities, and economy benefiting?" from our institutions of higher learning. Research and innovation have the potential to directly impact commercialization ventures through technology transfer, resulting in spin-off companies and the creation of economic development clusters. In an effort to encourage research and entrepreneurial activity within Kentucky's universities, the forum presented research and commercialization initiatives that directly improve the lives of Kentuckians.

The second annual Translational Research Forum will be hosted by UK in the fall of 2008.

Regional Stewardship Program

With the enactment of House Bill 380 by the 2006 General Assembly, Kentucky became the first, and still only, state to define and fund a statewide effort to support regional partnerships among all of its comprehensive universities. Funding of \$4.8 million, during the 2006-2007 biennium, was provided to the Regional Stewardship Program. The Council on Postsecondary Education administers this program and distributes funding to the comprehensive universities.

The overarching goal of the Regional Stewardship Program is to promote economic development, livable communities, social inclusion, improved P-12 schools, creative

governance, and civic participation through public engagement activities initiated by comprehensive university faculty and staff.

In order to accomplish this goal, the program provides funding for the comprehensive universities in three areas. First, infrastructure funds support the development and maintenance of organizational structures, personnel, information systems, and community relationships necessary to sustain stewardship activities. Second, regional grant funds support comprehensive university efforts to build intellectual capacity in targeted areas identified by regional leaders as important to improving quality of life in the region. And third, stewardship initiative funds support specific public engagement activities at the universities that improve economic prosperity, quality of life, and civic participation in the region or state.

Eastern Kentucky University, Kentucky State University, Morehead State University, Murray State University, and Western Kentucky University are currently in the process of establishing their regional advisory boards and aligning their organizational structures and policies with the objectives of the Regional Stewardship Program.

Northern Kentucky University, because of its participation in a pilot program sponsored by the Alliance for Regional Stewardship, the American Association of State Colleges and Universities, and the National Center for Higher Education Management Systems, has made significant infrastructural changes and is in the process of building intellectual capacity in the areas of early childhood development and literacy, mathematics education, mental health, and technology assistance in accordance with the regional plan *Vision 2015* established by regional leaders and the public.

Two of these initiatives – mathematics education and technology assistance – are directly related to the KBE. In order to enhance economic competitiveness, one of the region's strategies is to focus on industry sectors, such as advanced manufacturing, financial, healthcare, business services, and technology, which have the highest growth potential for high-paying jobs.

Over the next year, NKU will focus on mathematics education because of the importance of STEM-related disciplines to economic development and to expand the university's work as the home of the Kentucky Center for Mathematics. Faculty will provide workshops that emphasize the use of technology in the teaching of mathematics, create a report of the resources needed to scale-up the Kentucky Center for Mathematics' existing intervention and coaching programs, and research best practices in high school mathematics education.

NKU, through its Infrastructure Management Institute, will work with companies in the region to assess and address their technology needs and complete Web development projects for private companies and nonprofit organizations. These efforts are aimed at supporting start-up companies and helping small- and medium-sized businesses grow and prosper.

The Council anticipates the same regional engagement from its other comprehensive universities as they fully implement the Regional Stewardship Program.

Kentucky's Technology Infrastructure

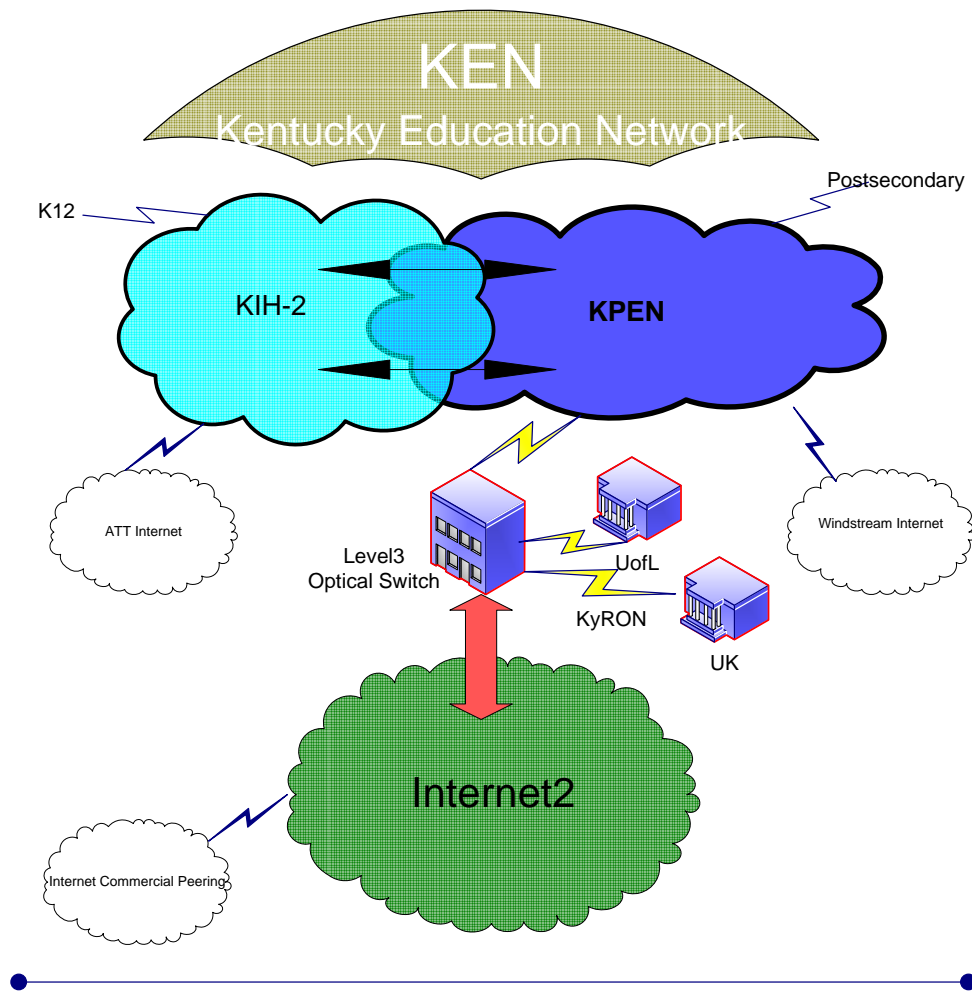
Richard Florida and other economists exploring the creation of a KBE in states and nations internationally point to the importance of a sophisticated technology infrastructure that supports education, innovation, and collaboration. Kentucky has made significant progress in putting this infrastructure in place.

The Kentucky Education Network - www.ken.ky.gov

Kentucky was among the first states in which the entire education community, under the coordination of the Education Cabinet, collaborated to create a joint budget request for technology initiatives that would benefit the entire education community and the public at large. The result was a \$30 million appropriation to build a high-speed data network called Kentucky Education Network (KEN).

The vision of KEN is to develop a seamless education-centric network that will grow and scale to meet new, increasing, and unforeseen needs to support equitable life-long learning for all Kentuckians; break down the physical and political barriers between secondary and postsecondary education; and share learning content and resources throughout P-20 both virtual and physical.

KEN facilitates the development, deployment, and operation of a set of seamless P-20 applications. It supports advanced research and education applications in order to **further** Kentucky's educational agenda. It connects every college, university, and K-12 school district in the state to enhance the learning experience of students at all educational levels. The agencies of the Education Cabinet and their statewide locations also are connected to the network.



In addition to KEN, the Council has been instrumental in Kentucky's institutional participation in advanced technologies including Internet2 and KyRON. Both the University of Kentucky and University of Louisville have been active members of these consortiums since their development. The comprehensive institutions are currently establishing connectivity advancing commercial traffic and thus expanding economic opportunities.

Internet2 – www.i2.ky.gov

Internet2 is a not-for-profit advanced networking consortium comprising more than 200 major U.S. research universities working in cooperation with 70 leading corporations, 45 government agencies, laboratories, and other institutions of higher learning as well as over 50 international partner organizations. Led by the research and education community since 1996 to solicit interest in Kentucky's economic development priorities, Internet2 promotes the missions of its members by providing both leading-edge network capabilities and unique partnership opportunities with the business community. Since 1996, only the University of Kentucky and University of Louisville have been members of Internet2.

In 2005, Kentucky joined the Internet2 Sponsored Education Group Participants (SEGP) program under the sponsorship of the University of Kentucky to open Internet2 access to all

universities, community colleges, schools, libraries, museums, the Education Cabinet, and its agencies.

Internet2 applications enable collaboration among researchers, instructors, students, and interactive access to information and resources in a way not possible on today's Internet. For example:

1. K-20 interactive collaboration – A science teacher in Owsley County can dissect an anatomical specimen for her class, zooming, rotating, and putting it back together, and discuss this virtual dissection with researchers at Murray State University and Stanford University in real time.
2. Resource-sharing – Math teachers in Clay County can interactively participate in professional development workshops conducted live from the University of North Texas and Western Kentucky University without leaving their classrooms.
3. Remote instrumentation – A student in Frankfort High School taking a biology class can operate a microscope located in Lehigh University in real time.
4. Digital libraries – A student in Bowling Green can perform simultaneous, intelligent search and retrieval of KET's rich reservoir of videos, Kentucky History Center's oral tapes and artifacts, and Filson Club's photographs as she works on her multimedia assignment on Western Kentucky University's History Center.
5. Performing arts – A student of violin in Powell County can audition or take a master class with the Manhattan School of Music via Internet2 H.323 videoconferencing with low latency in audio and video transmission.

Recently, the Internet2 network upgraded to new technology. Previously, Internet2 was using a 10 Gbps (billion bits per second) backbone network. The Internet2 NewNet now in place across the U.S. has increased the backbone speed by 10 times to 100 Gbps.

Typical connections to the network are 10 Gbps links. NewNet provides a new dynamic network service. The dynamic network service has the capability of setting up short-term high-speed connections quickly, fostering collaboration and special projects in a way not possible on today's network.

Louisville is fortunate to be one of only 26 Internet2 optical switching nodes in the nation. The University of Louisville and the University of Kentucky have been long-term users of Internet2. Now, the larger education and research communities have direct access via the Kentucky Postsecondary Education Network (KPEN).

KyRON – www.kyron.net

The latest high-speed networks use fiber optics and optical network technology to provide much greater bandwidth at a reasonable cost. Kentucky has created a Regional Optical Network (KyRON) to extend the capabilities of Internet2 to support education, research, government, and economic development across the state. KyRON makes it possible for the full capabilities of Internet2 to be extended at very high speeds to public and private organizations throughout Kentucky.

The optical switching node in Kentucky became operational in April 2007 and the University of Louisville completed a fiber link into the new Internet2 facility in early May 2007. The University of Kentucky will upgrade its current Atlanta Internet2 connection to a 10 Gbps link to Louisville in early 2008. The remainder of the Kentucky education community, whose access is sponsored by KyRON, is expected to start migrating to KyRON later in 2008.

It is expected that Internet2 and KyRON will be used for collaboration between K-20 education and research institutions, government, health care, and other organizations through resource sharing, access to digital libraries, interactive video-conferencing, high-speed data services, and other capabilities. This connectivity helps Kentucky and its people to compete in the global information economy. The iMedia technology of the 21st century with daily access through the information community provides untold economic opportunities, including idea sharing leading to potential investments in both intellectual capital and economic development.

Kentucky Virtual Campus and Virtual Library – www.kyvc.org, www.kyvl.org

Kentucky has a rich tradition in distance learning. It ranks first in the southeast for the number of students taking distance learning courses. To keep Kentucky at the top and take it to the next level, the Kentucky Virtual University underwent a year long strategic planning process that resulted in a new name (Kentucky Virtual Campus) and a renewed focus on eLearning for all Kentucky citizens. One of the goals of these resources is to make available to all Kentuckians, as well as “digital visitors,” the resources needed to create a KBE and a well-trained workforce.

Vision: The Kentucky Virtual Campus and Virtual Library aspire to create a technology-supported, lifelong learning environment that results in better lives for Kentucky’s people.

Mission: The Kentucky Virtual Campus serves as a statewide advocate for access to learning through technology, a convener of partners that use resources effectively, and a catalyst for innovation and excellence in eLearning.

All Kentuckians will have equitable access to quality library and information resources and qualified, well-trained staff to support the Kentucky Virtual Campus as well as meet broader needs for learning, working, and living.

Educational Pipelines to Knowledge-Based Economies

The Council is joined by P-12 and adult educators in creating the educational pipeline needed to produce a KBE in Kentucky. Efforts to provide enhancements to the STEM pipeline are a focus of many initiatives. The following summarize current pipeline activities.

Statewide Joint Engineering Program

Begun in 2001 with funding from the Science and Technology Trust Funds, the Statewide Joint Engineering Program was designed to engage more students in science and math careers to create a Kentucky workforce to support a KBE. This joint program involves the leadership of engineering faculty at Murray State University, Western Kentucky University, University of Kentucky, and University of Louisville. Through web-based learning more students across the Commonwealth have access to careers in engineering. These programs at the four institutions continue to increase enrollments and have three ABET-accredited programs. A fourth program in electrical engineering is in line for accreditation with its first graduate in the spring of 2008. The Council monitors enrollments, degree attainment and the development of peer-reviewed quality on-line curriculum development. Providing transfer opportunities for students in pre-engineering programs at the community and technical college system continues to be goal of the bachelor's engineering degree-granting institutions.

The Council's Statewide Engineering Strategy also calls for P-16 programs to increase the number of students preparing for careers in engineering and related careers. The Council has convened private sector, P-12, and postsecondary representatives in developing such a strategy. The 2006-08 Council budget request contained funding to implement programs in middle/high schools and community colleges that will increase the number of students in the pipeline for careers in science, technology, engineering, and math while utilizing the increased capacity created by the joint programs.

A key component of the Statewide Joint Engineering Strategy is to increase the number of Kentucky high school graduates prepared to succeed in engineering programs at the postsecondary level. The Council received 2006-08 funding to assist the Kentucky Department of Education in developing an articulated engineering pipeline to increase the number of Kentucky students prepared for engineering degrees through implementation of *Project Lead The Way®*, the model pre-engineering curriculum recommended in the 2006 National Academies report, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*. The funding to school districts across the Commonwealth to implement or expand the *Project Lead The Way®* curriculum has been quite successful with over 30 districts now offering this curriculum. Schools are challenged to provide computer availability, teacher availability/certification, elementary school integration, middle school program, student progress, instructional space, and a student recruitment plan to participate in PLTW. The University of Kentucky became the PLTW national university affiliate in 2007. Through the affiliate program, educational opportunities for middle/high school math and science teachers may now be provided in Kentucky rather than seeking such training out of

state. Additional school districts are ready and interested in joining the PLTW program. Early evaluations of Kentucky's PLTW school districts' participation are very positive. The Council has requested \$1.45 million in the 2008-10 budget to expand the programs to additional districts. In a 2007 joint KDE/CPE survey of superintendents, these new districts committed to provide required matching funds to join the program.

Teacher Quality Initiatives

2007 Teacher Quality Summit

The 2006 *Gathering Storm Report*⁴ outlines a comprehensive strategy to address our nation's need for high-quality jobs and energy independence. Its recommendations focus on P-16 education, postsecondary education, and economic policy. Improving the preparation and professional development of teachers and increasing the pipeline of students ready to earn degrees in science, technology, engineering, and mathematics are critical to improving the quality of life for all Americans. For several years, the Council has sponsored a Teacher Quality Summit. Recent summits have focused on STEM education and world language learning and increasing the availability of world language teachers as requisite to Kentucky's global competitiveness. The event brings together chief academic officers, deans and faculty in arts and sciences and education, and K-12 educators as well as other state policymakers to discuss postsecondary education's responsibility for improving teacher quality in Kentucky.

Educational Leadership Redesign

House Joint Resolution 14 (HJR 14), sponsored by then Representative Jon Draud, directed the executive director of the Education Professional Standards Board, with the cooperation of the commissioner of education and the president of the Council on Postsecondary Education, to establish an interagency task force to collaborate with the public and private postsecondary education institutions for the redesign of preparation programs and the professional development of educational leaders. Task force members worked in one of four groups developing recommendations for the redesign process. The task force began its work in July 2006. It provided a report to the Education Professional Standards Board (EPSB) in June 2007 and to the Interim Joint Committee on Education in October 2007. The workgroups focus on preparation programs, professional development, induction and working conditions, and doctoral programs.

The task force recommendations have resulted in collaboration among Kentucky's key educational partners in redesigning preparation and professional support of school and district educational leaders. The result is a seamless, career development process with a clear focus on improving student learning, growth, and achievement. Creating a quality STEM educator workforce and subsequent retention of that workforce will require the new programs of school leadership being implemented in the redesign process.

Other Pipeline Initiatives

Kentucky Satellite Project

One of the most successful pipeline programs related to the engineering strategy has been the development of a satellite project in collaboration with faculty and students from a number of the public postsecondary institutions. KentuckySat (KySat) emerged through the work of the Kentucky Science and Technology Corporation's (KSTC) Advanced Concepts Office at NASA Ames Research Center in Mountain View, California. Created in 2004, the office facilitates and extends KSTC's and Kentucky's work in areas related to space research and development (R&D) and planetary sub-surface exploration. KySat is a joint-enterprise involving public organizations, colleges and universities, and private companies in a student-led initiative involving the design, build, launch, and on-orbit operation of small satellites to promote science, technology and engineering, innovation, and education. KySat's strategy is to train and support students in the dynamics of spacecraft design, development (including payloads), launch, and on-orbit operation of small satellites as a means of extending science, technology and engineering, education, innovation, and entrepreneurship in Kentucky.

KySat students launched their first satellite in December 2007 from White Plains, New Mexico, utilizing a NASA launcher. Another launch is possible for April 2008. The interest of students and faculty from each of the postsecondary institutions has been overwhelming. The program has received national and international acclaim. The second cohort of students is realizing the benefits of the experienced gained working with the first year students. Plans are underway to continue this component of cohort mentoring. National contracts for payloads are being commercialized and Kentucky is receiving very positive publicity as the first state to attempt such a program.

National Math and Science Initiative

In 2007, lead by KSTC in collaboration with the Department of Education and the Council, Kentucky won a \$13.2 million national math and science initiative (NMSI) competitive award in STEM education. This grant will fund training and incentives for advanced placement (AP) and pre-AP mathematics, science, and English courses in Kentucky's high schools. Funding over six years for extensive training of teachers, identification and cultivation of lead teachers, extended time on task for students, and financing incentives based on academic performance is jointly provided from ExxonMobil Corporation, the Bill and Melinda Gates Foundation, and the Michael and Susan Dell Foundation.

Kentucky is one of only seven states to receive this funding. The CPE STEM Task Force recommendations provided a foundation that, in part, enabled Kentucky to successfully compete for the grant, demonstrating a statewide commitment to STEM initiatives.

College Transfer

Students earning associate and bachelor's degrees, as well as advanced degrees, are vital to Kentucky's economy. Economic growth from which per capita income is derived is directly impacted by educational attainment of the population. To compete with other states and

nations, Kentucky must exceed national averages for educational attainment. Projections of such attainment, based on current per capita income and elements needed for growth, are included in a KSTC study commissioned by SRI International⁵. The growth of Kentucky's Community and Technology College System (KCTCS) and its provision of associate degrees have opened doors for many Kentucky students to achieve this educational accomplishment. However, for Kentucky to succeed more of these students must transfer and complete a baccalaureate degree.

Since the late 1990's, the Council has been actively engaged in the expanded efforts to promote college student transfer. Since 2003 the number of college student transfers from two year to four year institutions has steadily increased. In 2006-07, Kentucky had the largest number of transfers in the history of the state with 4,479 students transferred from KCTCS to one of Kentucky's four year public or independent universities. This represents a 20 percent increase over the number who transferred in 2002-03 but a less than 1 percent increase over 2005-06. Kentucky will need this figure to increase to more than 11,000 to meet the state's 2020 Double the Numbers (2X) goals. This will require more than a 10 percent increase in transfers from KCTCS per year for the next 14 years.

The General Education Transfer Policy adopted in 1996 was revised in 2004 and is the foundation for Kentucky's transfer initiatives. It provides Kentucky students with guaranteed transferability of their general education coursework from one public postsecondary institution to another. Through the completion of AA/AS transfer degrees (meeting all required transfer components) students are admitted at junior level standing, and the universities accept the corresponding general education credits as meeting their institution wide lower-division general education requirements.

The statewide transfer technology infrastructure is essential to the transfer process for students, advisors, and other administrators. The technology infrastructure enables students to access information that is critical to decision making throughout their college career. The Course Applicability System (CAS) has been an important tool for students and advisors to access information about transfer course equivalencies and enabling students to determine their time to degree completion. Since the beginning of the implementation of CAS in 2005, the number of student accounts has grown to 11,980. The completion of the statewide transfer technology infrastructure also will include the integration of a statewide electronic transcript exchange that will increase efficiency in obtaining student records and enable students to receive information from institutions earlier.

The development of the first Community College Transfer Feedback report was completed, published, and distributed in September 2007. This report contains individual reports for each community and technical college along with a total systemwide report for KCTCS. This report will aid in identifying factors contributing to the success of transfer students at four-year institutions. It also will help determine what programs at KCTCS most effectively promote transfer.

In 2004, the Council, in cooperation with KCTCS, conducted a comprehensive study of barriers

to transfer involving an estimated 5,000 KCTCS students and key transfer personnel from KCTCS and the universities. The results of that survey clearly indicated that two of the major barriers to transfer were: a) financial challenges due, in part, to inadequate financial aid programs and b) a lack of good advising about transfer, and c) motivation to transfer for many students who did not see the value of a baccalaureate degree. In response to that survey, the Council is launching a campaign to promote the value of transfer and the baccalaureate degree, targeting KCTCS students and staff. As part of the campaign, the Go Higher Kentucky college access web portal, supported by the Kentucky Higher Education Assistance Authority (KHEAA), is being enhanced to provide more information and better utility for prospective transfer students including a process for on-line applications. In addition, the Council and KCTCS are implementing a pilot transfer scholarship program supporting completion of the associate degree and transfer to a university.

The Council will continue to monitor institutional progress regarding college student transfer through its key indicator system, including working with institutions to develop institutional goals for transfer and providing performance funding for transfer success.

GEAR UP

GEAR UP Kentucky is a \$42 million, six-year federal grant acquired by the Council that encourages low-income young people to stay in school, study hard, and take the right courses for college. The program is focused on improving the skills of at-risk students and influencing their educational choices through enhanced guidance and support, particularly in math and science achievement. GEAR UP also helps students prepare and plan for college and become aware of financial aid opportunities.

Unlike many other programs, GEAR UP works with partnerships of schools, colleges, businesses, community, and non-profit organizations. Partners provide early intervention services for students and work to transform the culture of a school so that every student is prepared for and encouraged to pursue college. Eighty-one schools (enrolling more than 15,000 students) currently participate in the program.

The U.S. Department of Education awarded Kentucky its second GEAR UP grant in 2005 extending the Kentucky program through 2011. An earlier grant in 2000 awarded the Council \$21 million over five years. Assessment of student achievement during the first grant clearly documented the positive effects of the program on student achievement. Administered by the Council, program staff members work with middle schools to continue making improvements in school curriculum, instruction, and school climate ensuring achieved changes with grant resources. For information on the federal GEAR UP initiative, visit www.ed.gov/gearup.

For Kentucky to succeed in creating a KBE, it must ensure that **all** students have the opportunity to succeed in college. Kentucky GEAR UP is one of the largest state initiatives focused on that goal.

Adult Education

In order for Kentucky to create a vibrant KBE, the state needs a skilled workforce. Research on the educational attainment of Kentucky adults show that one in five Kentuckians over the age of 25 does not have a high school diploma or a GED⁶. This constitutes a very large portion of the state population who must be informed, reengaged, and motivated to continue their education so that they can contribute to the growth of a KBE.

The Council understands the importance of improving the educational levels of working-age adults. In the Council's *Double the Numbers Plan*¹, a goal has been set to increase the adult college participation rate from 3.6 percent to 4.5 percent. Kentucky Adult Education, the unit of the Council which ensures that instruction is available statewide to persons with low literacy skills or who lack a high school diploma, has the goal of increasing GED graduates to 15,000 annually by 2020 and increasing the college-going rate of GED graduates to 36 percent.

KYAE, most recently authorized by federal and state law in 1998 and 2000, ensures that adult education and GED instruction is available in all of the Commonwealth's 120 counties. A new policy framework was instituted in 2007 which increases program focus on raising student attainment and increasing the number of GEDs earned by adult education students. These increases are essential to growing a broad-based knowledge economy. The large number of persons without the most basic educational credential or skills must be brought into mainstream efforts to develop a KBE. The demographics of the state show that there are not enough young people in Kentucky to meet the future skilled workforce needs or to achieve the 2020 goals for the number of baccalaureate degrees. Adult students without a high school credential or adults who have some college credit must be brought back into the educational system to raise their knowledge and skills and to help the Commonwealth meet the demand for educated workers in a KBE.

Kentucky Adult Learner Initiative – In addition to low-literacy adults served by KYAE, Kentucky has 520,000 adults with some college but no college degree. The Council successfully competed for a \$500,000 grant from the Lumina Foundation to support the Kentucky Adult Learner Initiative. This initiative, lead by the Council, is a partnership among multiple stakeholders, including all public two- and four-year institutions; the Association of Independent Kentucky Colleges and Universities; the Kentucky Board for Proprietary Education; the Kentucky Education Cabinet; the Kentucky Economic Development Cabinet; the Kentucky General Assembly; the Kentucky Higher Education Assistance Authority, the Kentucky Chamber of Commerce and Associated Industries of Kentucky, which represents business and industry; and the Kentucky Press Association and the Kentucky Broadcasters Association.

This multi-year initiative began with a statewide summit in February 2008. The summit featured national leaders with expertise in best practices in adult learning. After the summit, policy work groups consisting of postsecondary institutional representatives, legislators, state government agency representatives, business and industry representatives, and Council members will be established to draft policy recommendations to make postsecondary education in the state more

adult-friendly and encourage more adults to pursue degrees. The goals of this initiative are to create a comprehensive policy framework at both the state and institutional levels to support adult college attendance; promote the importance of baccalaureate degrees among the working-age population through a marketing campaign and initiatives with employers; and increase the responsiveness of postsecondary institutions to the unique needs of adult learners.

One target market includes adults with a high number of credit hours earned but no degree. Through *Project Graduate*, the Council is working with the public postsecondary institutions in the state to help them recruit these students back to school to finish their degrees.

Knowledge-Based Economy: Summary and Next Steps

Kentucky has made enormous progress in raising educational attainment since the beginning of postsecondary education reform. However, the pace of improvement to reach 2020 goals must be accelerated. Similarly, progress has been seen in some economic indicators, as a result, in part, of the efforts outlined in this report. However, here too, the pace must increase, particularly if Kentucky is to move the dial to increase per capita income, a key indicator of economic progress. The Council has included targeted expansion of postsecondary education's work in economic development in its 2008-10 budget request. Funding of those requests will advance Kentucky's economic development agenda.

It is the case, however, that Kentucky cannot succeed in its KBE efforts if it does not significantly raise its educational attainment. States with low education levels are and will continue to be the states with low per capita income and high costs in health care, criminal justice, and public assistance. The Council has developed a vision for Kentucky with its *2020 Double the Numbers Plan*² to increase college graduates. The plan is ambitious and contains a rationale for acceleration. The benefits of doubling the number of college degree holders by 2020 are directly related to a change in personal income producing in turn General Fund growth. The growth in General Fund revenues by 2020 is conservatively estimated to be between \$10.5 and \$11.7 billion⁵, representing the most dramatic transformation of Kentucky's economy in its history.

As part of the *Double the Numbers Plan*, a long-term funding approach has been proposed that balances the institutions' need for stable funding with the state's need for increased efficiency and return on investment, as well as students' need for affordable, accessible education. The universities understand that adequate, consistent investment from the state demands specific, measurable results. Kentucky will strengthen its accountability system and create new incentives for improving outcomes, productivity, and efficiency. There will be rewards for high performance and consequences for not achieving targets. The *Double the Numbers Plan* calls for a sizable investment in postsecondary education in Kentucky that will yield enormous economic and community benefits, a direct response to the 1997 Postsecondary Education Improvement Act.

Beyond increased resources, economic development efforts can be enhanced by increased collaboration and coordination among agencies and groups charged with an economic development agenda. Initial meetings with the secretary of the Economic Development Cabinet have produced promising results in facilitating collaboration between the cabinet and the Council. The recent Kentucky Chamber of Commerce Task Force on Postsecondary Education report⁷ provides opportunities to better engage the private sector. The opportunity exists for the Office of the Governor to significantly advance collaboration and synergy among the public and private sector in the economic development arena through convening the appropriate partners and creating the infrastructure necessary to ensure collaboration and synergy between Kentucky's various KBE initiatives. Early in the postsecondary reform the state had an Innovation

Commission that served this purpose. Having such infrastructure would be a significant step forward for Kentucky's economic development agenda.

In summary, postsecondary education has committed significant time and resources to advancing a knowledge-based economy in Kentucky. The initiatives summarized here represent only the part of that effort with which the Council is directly involved. Much more work is occurring at each of Kentucky's institutions. The 2005 National Academies' *Rising Above the Gathering Storm*⁴ and subsequent 2007 update *Is American Falling Off the Flat Earth?*⁸ have spurred national attention to the ability of Americans to compete in the 21st century. Congress, state legislators, educators, parents, and students are responding to this call to action. Kentucky must create an economy that attracts high-level jobs and educated people from outside Kentucky and must retain more of its graduates. Kentucky also must generate the resources from its economy to provide consistent support to the implementation of the *Double the Numbers Plan*. Improving Kentucky's economy requires coordinated efforts among multiple agencies and groups and creating the workforce to support that economy.

References

1. Kentucky Science and Technology Corporation. 2007 Annual Report on Investments, September 2007. (www.cpe.ky.gov/policies/economic/KnowledgeEc.htm)
2. Council on Postsecondary Education. *Double the Numbers, Kentucky's Plan to Increase College Graduates*, 2007. <http://cpe.ky.gov/NR/rdonlyres/76889317-86C5-4AFF-9046-AD95E4137602/0/DoubletheNumbersPlanFINALNov15.pdf>
3. Bucks for Brains Report <http://cpe.ky.gov/NR/rdonlyres/20EC990E-E16D-4B03-BF67-FB168C2C2973/0/Bucks4Brainsfinalreport11107.pdf>
4. Committee on Prospering in the Global Economy of the 21st Century: An Agenda for American Science and Technology, National Academy of Sciences, National Academy of Engineering, Institute of Medicine. *Rising Above the Gathering Storm*. National Academies Press, 2005. <http://www.nap.edu/catalog/12021.html>
5. *Kentucky Per Capita Income Analysis*. SRI International, Arlington, VA. 2006. <http://www.kstc.com/docs/FINAL%20KY%20PCI%20Report%202-23-06%20REVISED%2010-06.pdf?CFID=1160590&CFTOKEN=96124908>
6. Kentucky Council on Postsecondary Education, Adult Education Data Portal. <http://cpe.ky.gov/info/adult/index.htm>
7. Kentucky Chamber of Commerce, Task Force on Postsecondary Education Report, 2007. http://www.cpe.ky.gov/NR/rdonlyres/6388D033-2CE9-49F0-974B-A39F51DD630B/0/KyChamber_fullreport.pdf
8. Augustine, NR. *Is America Falling Off the Flat Earth?* National Academy of Sciences, National Academy of Engineering, Institute of Medicine. National Academies Press, 2007. http://www.nap.edu/catalog.php?record_id=12021#toc
9. Watts, A. *Doubling Kentucky's Degree Holders, Benefits and Challenges of CPE's Plan*. Foresight, Kentucky Long-Term Policy Research Center. No. 49, 2007. <http://www.kltprc.net/foresight/no49.pdf>

